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ABSTRACT

The paper discusses high school students' attitudes towards teachers' verbal questioning behavior and assesses the relevance of students' preferences to test score gains. Data were sought for several questions. What cognitive levels of teacher verbal questioning behavior do social studies students prefer? What is the relationship between students' preferences and overall test score gains? Do students gain in achievement as measured by levels of questions corresponding to their preferences? Forty-three American history students were exposed to four treatments of questioning over four weeks. Three parallel forms of an achievement test and a preference inventory served as data sources. The test questions related directly to the objectives the treatment teachers implemented during the four weeks. Findings indicate that students did not show a preference for higher level questions and that those students who preferred their teachers to ask low-level questions performed best on tests incorporating correspondingly low-level questions. Implications of these results are that new curricular and instructional approaches must receive a degree of acceptance by students before their effectiveness can be evaluated and that students' reactions to teachers' use of higher, cognitive-level questions is more positive in theory than practice. (Author/DB)

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THE PREFERENCES OF AMERICAN HISTORY STUDENTS FOR THE COGNITIVE LEVELS OF TEACHERS' VERBAL QUESTIONING BEHAVIOR AND THE RELATIONSHIP OF PREFERENCES TO ACHIEVEMENT

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To a very great extent, the success of the inquiry instructional approach in the social studies crucially depends on the classroom teacher's ability to stimulate student thinking through his verbal questioning behaviors. As strongly advocated by such leading social studies educators as Wesley and Wronski (18), Hunt and Metcalf (12), Fenton (6), and Massialas and Cox (17), this instructional strategy provides opportunities for students to engage in higher cognitive level thinking as they formulate hypotheses, project generalizations, make predictions, devise plans, solve problems, and offer supported opinions.

Although the influence of teachers' questions in serving as a stimulus to the higher thought processes of students is well documented, very little is known of the relationship between teachers' questions and the outcomes of instruction. In order to determine if teachers who are using higher level questions are successful in achieving the objectives of inquiry, an assessment of the cognitive and attitudinal instructional outcomes needs to take place. Gall (8) supported the specific need to know the impact of teachers' questions on student behavior, and Kurfman (15) proposed one way to facilitate this by identifying the preferences of students for the cognitive levels of teachers' questions through instrumentation.

Determining students' preferences can play an important role in assessing the attitudinal outcomes of instruction. One of the goals of the inquiry approach is the development of a positive student reaction generally toward this mode of instruction and specifically toward responding to higher level questions. If students did not prefer to respond to divergent and evaluative level questions, their attitude toward the inquiry approach would be affected.

Although research has demonstrated that teachers can engage students in inquiry with higher level questions (5), students may become frustrated in the process because they are very subjective in their thinking (2); less motivated, distracted easily, or impulsive by nature (13); or are simply bored (14).

Successful efforts at developing preference instruments related to science subject matter knowledge have previously been accomplished by Heath (11), Atwood (1), and Marks (16). Kurfman (15) suggested that the science models be adapted for use in the social studies.

Another major outcome of instruction is student growth as reflected in achievement gains. Bloom (3) concluded that this cognitive outcome is probably the most important change teachers seek in students because it is also a measure of the teachers' performance. Achievement, as noticed in test score gains, is another important objective of the inquiry approach. Students' attitudes toward inquiry and achievement in learning would be affected adversely if they did not prefer to respond to higher level questions. Students would more than likely become passive and receptive learners rather than active and involved participants.

The general problem under investigation in this study was the determination of the effects of teachers' verbal questioning behavior on students. Specifically, data were sought for the following questions:

1. What cognitive levels of teacher verbal questioning behavior do social studies students prefer?

2. What is the relationship between students' preferences and overall test score gains?

3. Do students gain in achievement as measured by levels of questions corresponding to their preferences?

METHODOLOGY

Subjects. The sample was composed of two heterogeneously grouped (excluding advanced placement and special education students) eleventh grade American history classes selected from Field High School, a suburban Akron (Ohio) high school. The treatment classes, consisting of a total of 43 students, were selected by comparing the mean scholastic averages of the students over two grading periods for each of the 11 American history classes. The two classes closest to the overall mean were chosen. Using the t test procedure, it was determined that no significant differences existed between the sample and the population of American history classes at the school. The t test procedure was also used to compare the mean total pretest scores for both treatment classes. No significant differences existed between the treatment classes. The two regularly assigned teachers instructed the classes during the treatment period.

Design. The investigative design used in this study is represented graphically by Figure 1. For the purpose of determining students' achievement after exposure to four teaching treatments, three parallel forms of an achievement test were administered. The three forms consisted of a pretest, given before the beginning of the teaching treatments; four subtests, administered after each of the four treatments; and a posttest, given at the termination of the treatment period. In order to determine students' preferences for the cognitive levels of teachers' verbalized questions, a preference inventory was administered after the posttest.

Figure 1. - Design of the Study

Class	Teacher	Pretest (Four Divisions)	Questioning Treatment	Subtest	Questioning Treatment	Subtest	Questioning Treatment	Subtest	Questioning Treatment	Subtest	Posttest (Four Divisions)	Preference Inventory
1	A	O_{Pr}	X_1	O_1	X_2	O_2	X_3	O_3	X_4	O_4	O_{Po}	O_{In}
2	B	O_{Pr}	X_4	O_4	X_3	O_3	X_2	O_2	X_1	O_1	O_{Po}	O_{In}

The treatment teachers received instruction during a ten-hour training program in identifying, devising, and asking questions corresponding to the four cognitive levels of questions as defined by Gallagher and Aschner (9, 10): cognitive-memory, convergent, divergent, and evaluative. The two classes were subjected to four teaching treatments consisting of both teachers verbalizing four cognitive levels of questions during regularly scheduled class sessions over a period of four weeks. Teacher A asked cognitive-memory level questions during the first four days of the first week, convergent questions during the second week, divergent questions during the third week, and evaluative questions during the final week of the treatment period. In order to control the variable of sequential arrangement, Teacher B reversed the procedure and started with evaluative level questions during the first week and progressed to cognitive-memory questions during the fourth week. The fifth day of each week was reserved for administering the subtests.

Both teachers operated under the control that a minimum of 50 percent of their cognitive verbalizations had to be questions and a minimum of 50 percent

of the questions had to correspond to the appropriate treatment level. This control was consistent on a daily basis across the four treatments. The purpose was to insure that all 43 students would be exposed to a sufficient quantity of questions within each of the four cognitive levels before indicating their preferences.

The unit selected to serve as the basis for the treatment period related to the 1848-1877 era of American history. Major topics included the issues and events leading to the Civil War, domestic and foreign aspects of the War, and the Reconstruction Period. Division of the unit into four parts was necessary to correspond to the four treatments. The teachers' instructional objectives and topics within the unit were identical and they used the same printed and audio-visual materials during each of the four treatments.

INSTRUMENTATION

The instruments used to measure achievement were three parallel forms of an achievement test developed by the researcher. The three forms consisted of a pretest and posttest, composed of four divisions of cognitive-memory, convergent, divergent, and evaluative level questions; and four subtests, each of which was composed of cognitive-memory, convergent, divergent, or evaluative level questions. The pretest and posttest each consisted of 15 cognitive-memory level questions, 10 convergent questions, 3 divergent questions, and 3 evaluative questions. Correspondingly, the first subtest consisted of 15 cognitive-memory questions; the second, 10 convergent questions; the third, 3 divergent questions; and the fourth, 3 evaluative questions. The test questions related directly to the objectives the treatment teachers implemented during the four-week period.

A panel of professional educators was used to validate the cognitive levels of test questions. Reliability was determined by computing inter-rater test score agreement coefficients, using the Pearson Product-Moment correlation; for each of the four parts of the pretest and posttest, and the four subtests.

The instrument used to determine students' preferences was the Cognitive Preference Questioning Inventory (CPQI) developed by the researcher. The CPQI contains 39 items representing example teacher-questions from five major periods of American history. An item consists of four option-questions, each corresponding to one of the four cognitive levels of questions. The students were instructed to indicate their preferences for the kinds of questions an American history teacher might verbalize in class by selecting one of the four options contained in each item.

The validity of the CPQI was established by internally determining the representativeness of its contents. Two panels of professional educators judged the historical accuracy and cognitive levels represented by the item-option questions. The reliability was determined through pilot testing and examining the CPQI's internal consistency using the Kuder-Richardson 20 formula and point biserial correlations, and stability over an 11 day period using the Pearson Product-Moment correlation.

The adherance of the teachers to the four treatments was determined by systematically analyzing their verbalizations using a recording instrument to code the four cognitive levels of questions, cognitive statements, and affective and procedural verbalizations. One observer, in addition to the researcher, was trained in a modified version of the Gallagher-Aschner System.

All of the treatment teachers' lessons were coded live or by audio tape during the study. Using the Scott "pi" formula (7), interobserver agreement checks were made prior to the study, during the study at regular weekly intervals, and during the post-study period.

DATA TREATMENT

The data collected from the 43 students participating in the study were drawn from four sources: (1) pretest, (2) four subtests, (3) posttest, and (4) the CPQI. The four sources yielded 16 scores per student that were used in the analyses of data. The pretest and posttest each contained four divisions of questions corresponding to the four cognitive levels. Separate scores were computed for each division. Other scores were computed for the four subtests, each of which also corresponded to one of the four cognitive levels. A total of 12 scores were computed from the six tests. The remaining four scores were derived from the student responses to the CPQI. Each student received four cognitive preference scores that indicated the frequency with which he selected each of the four cognitive preference item-options.

Based on an approach used by Atwood (1), a visual analysis of the cognitive preference scores was made in order to form criteria to classify students into cognitive preference groups. It was decided that those students whose highest frequency of responses for one of the cognitive preferences was at least ten percent over the next highest frequency would be categorized into cognitive preference groups. Using this method of classification, 27 of the 43 students had indicated preferences and were categorized into preference groups. Formation of these groups was a necessary prerequisite for testing the hypotheses.

In order to determine if differences existed among the number of students distributed into each of the four cognitive preference groups, the Chi-square test was used. An analysis of variance on repeated measures was used to determine if differences existed among the four groups regarding total test score gains and test score gains made on the four divisions of each test. When the F-ratio was significant, post-hoc analyses were conducted using the Newman-Keuls tests.

RESULTS

Hypothesis 1. There are no significant differences in the numbers of high school American history students stating a preference for each of the four cognitive levels of teacher verbal questioning behavior.

As reported in Table 1 the analysis of these data revealed that there was no significant difference in the numbers of students distributed into the four cognitive preference groups. Hypothesis one was not rejected.

Table 1. - Cognitive Preference Groups: Chi-Square

Cognitive Preference Group	Number of Students
Cognitive-memory	7
Convergent	10
Divergent	4
Evaluative	6

$x^2 = 2.78$; df = 3; critical $x^2 = 7.82$; $p > .05$

Hypothesis 2. There are no significant differences in the mean gains made from (1) total pretest to total posttest scores, (2) total pretest to total subtest scores, or (3) total subtest to total posttest scores among the four cognitive preference groups.

As reported in Table 2 the analysis indicated that significant gains were made by the cognitive preference groups across the tests. The Newman-Keuls tests were run to determine where the gains were and which preference groups made gains. The results of these tests, shown in Table 3, indicated that the four cognitive preference groups individually made significant gains from total pretest to total posttest and from total pretest to total subtest. The gains made from total subtest to total posttest for the four groups were not significant. Because there were no significant differences in gains made among the four cognitive preference groups, hypothesis two was not rejected.

Table 2. - Cognitive Preference Groups and Total Pretest, Subtest, and Posttest Score Gains: Analysis of Variance

Source of Variance	D/F	Sum of Squares	Mean Square	F Ratio
Between				
Groups	3	51.62	17.21	0.50
Error (between)	23	793.86	34.52	
Within				
Tests	2	2052.84	1026.42	132.32*
Groups x Tests	6	20.58	3.43	0.44
Error (within)	46	356.83	7.76	

*P < .05

Table 3. - Summary Table for Cognitive Preference Groups and Total Achievement Test Differences: Newman-Keuls Tests

Variables	Number of Students	Tests	t Value
Cognitive-memory Preference Group	7	Pretest-Posttest	6.64*
		Pretest-Subtest	7.85*
		Subtest-Posttest	1.21
Convergent Preference Group	10	Pretest-Posttest	8.90*
		Pretest-Subtest	7.94*
		Subtest-Posttest	0.96
Divergent Preference Group	4	Pretest-Posttest	5.17*
		Pretest-Subtest	5.58*
		Subtest-Posttest	0.41
Evaluative Preference Group	6	Pretest-Posttest	6.52*
		Pretest-Subtest	7.02*
		Subtest-Posttest	0.50

*$p < .05$

Hypothesis 3. There are no significant differences in mean gains made from the (1) four divisions of the pretest to the four divisions of the posttest scores, (2) the four divisions of the pretest to the four corresponding subtest scores, or (3) the four subtests to the four corresponding divisions of the posttest scores among the four cognitive preference groups.

As reported in Table 4 the analyses of these data showed that significant gains were made by the cognitive-preference groups across each of the four divisions of the tests. The Newman-Keuls tests were run to determine the location of the gains and which preference groups made gains. The results of these tests, as shown in Table 5, indicated that the four cognitive preference groups (CM,C,D,E) individually made significant gains from the pretest to posttest on each of the four divisions of the tests. Therefore, there were no significant differences between the groups.

Table 4. - Summary Table for Cognitive Preference Groups and Test Score Gains by Test Sections: Analysis of Variance

Variables	Sources of Variance					
	Groups		Tests		Interaction	
	MS	F(3,23)	MS	F(2,46)	MS	F(6,46)
Cognitive-memory Test Section	21.46	0.82	571.90	29.95*	5.18	0.27
MSe for groups = 26.11 MSe for tests = 19.10						
Convergent Test Section	115.42	1.17	1590.77	73.70*	9.14	0.42
MSe for groups = 98.43 MSe for tests = 21.58						
Divergent Test Section	19.19	0.57	800.48	82.91*	11.93	1.24
MSe for groups = 33.52 MSe for tests = 9.65						
Evaluative Test Section	6.69	0.22	1547.98	181.43*	11.90	1.40
MSe for groups = 29.94 MSe for tests = 8.53						

*$p < .05$

Table 5. - Summary Table for Cognitive Preference Groups and Pretest to Posttest Section Score Differences: Newman-Keuls Tests

Variables	Number of Students	Test Section	t Value
Cognitive-memory Preference Group (CM)	7	Cognitive-memory	3.94*
		Convergent	4.63*
		Divergent	4.40*
		Evaluative	7.30*
Convergent Preference Group (C)	10	Cognitive-memory	4.71*
		Convergent	6.31*
		Divergent	5.90*
		Evaluative	9.42*
Divergent Preference Group (D)	4	Cognitive-memory	2.91*
		Convergent	2.98*
		Divergent	3.19*
		Evaluative	7.36*
Evaluative Preference Group (E)	6	Cognitive-memory	3.69*
		Convergent	5.15*
		Divergent	5.69*
		Evaluative	5.22*

*$p < .05$

Regarding the pretest to subtest gains, as shown in Table 6, the four cognitive preference groups individually made significant gains on the convergent, divergent, and evaluative divisions of the tests. Significant gains were made by the CM preference group on the cognitive-memory divisions of the tests, but the other preference groups did not make significant gains. Therefore, there was a significant difference in gains among the groups on the cognitive-memory division of the tests.

Regarding the subtest to posttest gains, as shown in Table 7, significant gains were made by theC preference group on the cognitive-memory division of the tests, but the other groups did not make significant gains. Therefore,

there was a significant difference in gains made among the groups on the cognitive-memory division of the tests. A related finding was that significant differences in losses were made by the CM preference group on the divergent and evaluative divisions. Because there was a significant difference in gains among the groups, hypothesis three was rejected for those preference groups on those tests.

Table 6. - Summary Table for Cognitive Preference Groups and Pretest to Subtest Section Score Differences: Newman-Keuls Tests

Variables	Number of Students	Test Section	t Value
Cognitive-memory Preference Group (CM)	7	Cognitive-memory	2.10*
		Convergent	5.88*
		Divergent	6.93*
		Evaluative	10.06*
Convergent Preference Group (C)	10	Cognitive-memory	1.23
		Convergent	6.26*
		Divergent	5.83*
		Evaluative	10.77*
Divergent Preference Group (D)	4	Cognitive-memory	1.78
		Convergent	3.68*
		Divergent	5.10*
		Evaluative	7.41*
Evaluative Preference Group (E)	6	Cognitive-memory	1.98
		Convergent	6.12*
		Divergent	6.69*
		Evaluative	7.06*

*$p < .05$

Table 7. - Summary Table for Cognitive Preference Groups and Subtest to Posttest Section Score Differences: Newman-Keuls Tests

Variables	Number of Students	Test Section	t Value
Cognitive-memory Preference Group (CM)	7	Cognitive-memory	1.84
		Convergent	-1.25
		Divergent	-2.53*
		Evaluative	-2.75*
Convergent Preference Group (C)	10	Cognitive-memory	3.48*
		Convergent	0.05
		Divergent	0.07
		Evaluative	-1.30
Divergent Preference Group (D)	4	Cognitive-memory	1.13
		Convergent	-0.70
		Divergent	-1.91
		Evaluative	-0.05
Evaluative Preference Group (E)	6	Cognitive-memory	1.70
		Convergent	-0.97
		Divergent	-1.00
		Evaluative	-1.84

*$p < .05$

DISCUSSION

A general implication of the results of this investigation is that new curricular and instructional approaches must receive a certain degree of acceptance by students before their effectiveness can be fully estimated through evaluation procedures. A specific implication for the social studies is that students' reactions to teachers' use of higher cognitive level questions emphasized in the inquiry approach is more positive in theory than in practice.

One important finding has been the lack of statistical significance between the numbers of students classified into groups based on their preferences for the cognitive levels of teachers' questions. Although the sample size may have influenced the finding, the students clearly failed to indicate a preference for either the divergent or evaluative level questions stressed in the inquiry approach. This finding seemed to support the views of Ausubel (2), Kagen (13), and Krug (14).

Another important result has been the statistically significant finding that students who preferred their teachers ask low level cognitive-memory and convergent questions performed best on tests composed of correspondingly low level cognitive-memory questions. Considering the traditional purpose and emphasis of teachers' questions, this finding was not a surprising one.

The review of literature revealed the discouraging conclusion that the emphasis of teachers' verbal questioning behavior has been on the lowest levels since the turn of the century (4, 8). This was especially evident in the field of social studies. Even with the thrust of the "new social studies," teachers have persisted in verbalizing questions that require low level thinking. In many respects the students have become conditioned over a long span of time to respond to narrow and closed questions that request the recall of knowledge and information.

The fact that many students may experience detrimental side effects while working at the higher cognitive levels could affect their performance on achievement tests. Although all the preference groups made predictable gains from pretest to subtest and from pretest to posttest, frustration, along with fatigue, may have accounted for the general loss in gains from subtest to posttest and the significant losses recorded for the cognitive-memory preference group. Test questions at the divergent and evaluative levels demanded higher level thinking and a greater quantity of writing.

From the results it seems safe to conclude that the students who preferred cognitive-memory and convergent level questions and performed best on cognitive-memory level written questions experienced a degree of comfort and security while using minimal thinking operations. If instructional approaches emphasizing the involvement of higher thought processes, such as inquiry, are to become accepted as integral parts of social studies programs, students must experience this same degree of comfort and security while using higher cognitive operations.

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